WSW

CITY OF TRACY

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July 1, 2004
Project No. 2005-3312

California Regional Water Quality Control Board
11020 Sun Center Drive, #200
Rancho Cordova, California 95670

Attention: Ms. Wendy S. Wyles
Chief - Waste Discharge to Land Unit

Subject: Comments on Tentative WDR for City of Tracy ASR Test Program

Dear Ms. Wyles:

Thank you for the opportunity to review the Tentative WDR for consideration at the Boards September 10, 2004, meeting. We have carefully reviewed the proposed resolution, and believe that several minor modifications should be made to more accurately reflect the conditions of the City's proposed ASR Testing Program.

It is important to note that the City's proposed ASR Test Program as outlined in the Engineers Report submitted with our WDR application was developed specifically for the conditions at the City of Tracy after 8 months of preliminary studies, aquifer tests, hydraulic analyses and geochemical/water quality modeling. The City's consultant, Padre Associates, Inc., are recognized experts in the field of ASR and are engaged in similar programs with numerous municipalities in California, including the City of Santa Barbara, the Monterey Peninsula Water Management District, East Bay Municipal Utility District, and Santa Clara Valley Water District. We believe their recommendations in the Engineers Report should be carefully considered with respect to the proposed monitoring program.

We hope the attached comments and recommendations are acceptable to RWQCB; we look forward to our meeting at 9:30 ~~2:00~~ p.m. on Wednesday, July 14, 2004 in order to discuss the proposed changes. If you have any questions or require additional information prior to the meeting, please feel free to contact Mr. Steven Bayley or myself.

Sincerely,

CITY OF TRACY

Dr. Nicholas Pinhey
Director of Public Works

Attachment: Proposed Modifications to WDR

c: West Yost Associates, Mr. Gerry Nakano, P.E.
Padre Associates, Inc., Stephen P. Tanner, P.E.

PROPOSED MODIFICATIONS TO TENTATIVE WDR FOR CITY OF TRACY ASR TEST PROGRAM

A. Modifications to Recitals Section

1. Add after Paragraph 24 (page 3):

   "WHEREAS, the city proposed program is designed to recover a minimum of 200 percent of the volume of water injected in the program; and

   WHEREAS, aquifer modeling studies by the City have shown that 200 percent withdrawal of the injected water will effectively recapture all of the injected waters and will ensure that no threat to water quality will be possible; and"

   Reason for change: These provisions are important findings and activities being implemented to ensure the safety of the groundwater basin.

2. Change Paragraph 25 (page 3):

   Delete: "prior to the initiation of subsequent testing cycles or"

   Reason for change:

   a. All four ISR cycles are necessary to make any conclusions regarding fate and transport of the injected water (including fate of THM's/HAA's). The attached Summary of ASR Operations details the differences in each of the four ISR cycles and the data gained from the individual tests.

   b. The recovery of 200 percent of the injected water (above) ensures the removal of any undesirable compounds and obviates the need for BPTC measures, since all injected waters will be removed before the test is concluded.

B. Modifications to Resolution Section

3. Change introductory paragraph of Resolutions:

   Change "first two cycles" to "four cycles".

   Reason for change:

   a. Al four ISR cycles are necessary to make any conclusions regarding the fate and transport of the injected water (including fate and transport of THM's/HAA's). Again, see the attached Summary of ASR Operations sheet.

b. The City will be issuing Interim Reports after reach ISR Cycle to RWQCB; this provides an opportunity for RWQCB to terminate or modify the test program if serious threats to water quality develop.

4. Delete Resolution #6 and replace with the following:

"6. The City of Tracy shall withdraw a minimum of 200 percent of the total volume of injected water by the conclusion of the four ISR cycle Test Program to ensure that no residual degradation of the groundwater basin occurs."

Reason for change:

The purpose of the original item is non-sequitur. THM's and HAA's will definitely be present and be detected in the monitoring wells - the MW's were designed and installed specifically to intercept the "bubble" of injected water as it expands in order to quantify both its velocity and direction. These data will be used to check and calibrate the computer models which will be used for long-term fate and transport predictions of a full-scale ASR program for the City.

The "new" Item 6 addresses the Test Programs assurance that all injected waters will be recovered and no residual impacts to the basin will occur.

5. Delete Resolution #7 and replace with the following:

"7. If, at the conclusion of the Test Program, including 200 percent withdrawal of the total injected volume of water, water quality analyses identify that any undesirable compounds are present at levels beyond 15 percent of the native groundwater quality, the City of Tracy shall continue to extract water from the well until said compounds are reduced to acceptable levels. The extracted water shall be beneficially used to the maximum extent possible."

Reason for change:

A primary goal of the ASR Test Program (particularly in ISR Cycles 3 and 4) is to observe and quantify the occurrence of THM and HAA degradation in the subsurface environment. The speed and amount of degradation has been shown to vary from site to site depending on a variety of factors, not all of which are known. Empirical study is currently the most accurate means of determination of the degradation process; however, several case studies in alluvial groundwater basins in California have shown little or no reduction of THM's occur in the first 1 to 3 weeks of storage, but substantial reduction occurs in 4 to 20 weeks of storage. The information gathered in the City's ASR Test Program will serve as the basis for recommended operating practices of any (future) permanent ASR program to ensure appropriate "storage" time is achieved prior to extraction of the water.

Regardless of the exact degradation parameters found, the groundwater basin protection is ensured by the withdrawal of a minimum of 200 percent of the total volume injected.

6. Change Resolution 9 as follows:

   Change "each of the first two ISR Cycles to "all four ISR Cycles", and add "the Regional Board may amend or modify, the conditions of this WDR based on the findings of each ISR Cycle's Interim Technical Memoranda."

   Reason for change:

   Same as for proposed changes to Items 3, 4, and 5 above. The first two ISR Cycles will provide only minimal information regarding the important issue of THM/HAA fate. The suggested addition is to clarify (or emphasize) the RWQCB's ability to provide continued input and regulatory control to the program as it progresses.

7. Change Resolution 10 as follows:

   Change "150 days" to "900 days".

   Reason for change:

   150 days is an inadequate time period to answer the RWQCB's (and the City's) most important question, "What are the issues related to the fate, transport, and degradation of THM's and HAA's in the subsurface environment of the City of Tracy?" This issue will be most thoroughly analyzed in ISR Cycles 3 and 4.

C. Modifications to Attachment A

8. Delete "Treated Injection Water Monitoring" table and substitute with attached Table A1.

   Reason for change:

   a. Injected water quality from the City's Jensen Plant (and its raw source water from the Delta Mendota Canal) does not vary measurably from day to day (or even week to week); rather the water undergoes slight seasonal variations which do not significantly affect its potability or stability. The Jensen Plant's treated water is monitored continuously for key water quality parameters to ensure both its potability and stability; more detailed analyses are performed daily, weekly, and quarterly. The frequency of analyses are directly related to each compounds Health and Safety effects and its natural variability in the source water. The proposed Table A1 reflects these priorities and the additional technical concerns for evaluating aquifer conditions.

9. Change Ground Water Monitoring, paragraph 3 as follows:

   Change "the ASR Demonstration Well and each of the monitoring wells", to "the ASR Demonstration Well or either of the monitoring wells".

   Reason for change:

   The two monitoring wells lie 45 and 86 feet away from the Demonstration Well, and are designed to perform the following functions:

   - Establish ground water gradient
   - Monitor Demonstration Well efficiency.
   - Measure "travel time" of injected water as it radiates from the Demonstration Well.
   - Monitor ion exchange and redox reactions occurring during subsurface migration.
   - Serve as an alternate water quality sample point during ISR storage periods.

   The locations of the monitoring wells were developed to provide these data at relatively short distances and travel times during injection. For this project, the time traveled to reach the monitoring wells is 2.5 days and 9 days, respectively, based on a 1,000 gpm injection rate. Because of the close proximity and identical design of the monitoring wells, they are considered essentially identical to the Demonstration Well from a water quality standpoint *during ISR storage and recovery operations*. There is, therefore, no need to concurrently monitor these sites during storage or recovery unless an anomalous condition arises.

10. Delete Groundwater Monitoring analytes table and substitute the attached Table A2.

    Reason for change:

    a. Constituents are modified to reflect the site-specific issues and compounds of concern as described in (8) above.

    b. Sample frequency has been divided into three groups to reflect the sampling frequency which is appropriate for each of the three operating modes, injection, aquifer storage, and recovery (i.e. extraction).

Table A1. Treated Injection Water Monitoring[1]

Constituent	Units	Type of Sample	Sampling Frequency
pH	Std.	Grab	Monthly
Nitrate as Nitrogen	mg/l	Grab	Monthly
Total Kjeldahl Nitrogen	mg/l	Grab	Monthly
Total Dissolved Solids	mg/l	Grab	Monthly
Sulfate	mg/l	Grab	Weekly
Standard Minerals[2]	mg/l	Grab	Monthly
Chlorine Residual	mg/l	Grab	Weekly
Ammonia	mg/l	Grab	Monthly
Iron	mg/l	Grab	Monthly
Manganese	mg/l	Grab	Monthly
Trihalomethanes[3] (EPA 8260B)	mg/l	Grab	Monthly
Haloacetic Acids[3] (EPA 8260B)	mg/l	Grab	Monthly
Total Coliform Organisms[1]	MPN/100 ml	Grab	Weekly

1 The list of constituents and schedule of monitoring presented in Table A1 represents the program required for WDR compliance. An expanded monitoring program developed to address technical issues is presented in Appendix A of the Engineer's Report.

2 Standard Minerals shall include the following: calcium, magnesium, potassium, sodium, chloride, total alkalinity (including alkalinity series), and hardness.

3 Only total trihalomethanes and haloacetic acids will be monitored and reported.

4 Using a minimum of 15 tubes or three dilutions.

Table A2. Groundwater Monitoring[1]

Constituent	Units	Type of Sample	Injection[2]	Storage	Sampling Frequency Recovery
Depth to Water	Std.	Grab	Weekly	Weekly	Weekly
Groundwater Elevation[3]	mg/l	Grab	Weekly	Weekly	Weekly
Gradient	mg/l	Grab	Variable[4]	Variable[4]	Variable[4]
Total Dissolved Solids	mg/l	Grab	Monthly	Monthly	Monthly
Sulfate	mg/l	Grab	Weekly	Bi-monthly	6x/cycle
Nitrogen Species	mg/l	Grab	Monthly	Monthly	Monthly
Standard Minerals[5]	mg/l	Grab	Monthly	Monthly	4x/cycle
Iron	mg/l	Grab	Monthly	Monthly	Monthly
Manganese	mg/l	Grab	Monthly	Monthly	Monthly
Trihalomethanes[6] (EPA 8260B)	mg/l	Grab	Monthly	Variable[7]	Variable[8]
Haloacetic Acids[6] (EPA 8260B)	mg/l	Grab	Monthly	Variable[7]	Variable[8]
Total Coliform Organisms[9]	MPN/100 ml	Grab	Weekly	Monthly	Weekly

1 The list of constituents and schedule of monitoring presented in Table A1 represents the program required for WDR compliance. An expanded monitoring program developed to address technical issues is presented in Appendix A of the Engineer's Report.

2 During injection, monitoring will be performed at both monitoring wells.

3 Groundwater elevation shall be determined based on depth-to-water measurements from a surveyed measuring point on the well.

4 Water level data to be collected continuously using pressure transducers and data loggers. Gradient calculations will be made at weekly intervals for ISR Cycles No. 1 and 2, and at monthly intervals for ISR Cycle No. 3.

5 Standard Minerals shall include the following: calcium, magnesium, potassium, sodium, chloride, total alkalinity (including alkalinity series), and hardness.

6 Only total trihalomethanes and haloacetic acids will be monitored and reported.

7 Bi-monthly for first 2.5 months of cycle, monthly thereafter.

8 3 times per cycle for ISR Cycles 1 and 2; 6 times per cycle for ISR Cycles 3 and 4.

9 Using a minimum of 15 tubes or three dilutions.

SUMMARY OF ISR CYCLES
CITY OF TRACY ASR TESTING PROGRAM

CYCLE NO. 1

Injection Volume: 20 million gallons (61 acre-feet)

Bubble Radius: 110 feet

Storage Period: 20 days

Primary Test Objectives:

- Monitor injection hydraulics.
- Monitor injectate arrival times at Monitoring Wells 1 and 2.
- Monitor "arrival" water quality at Monitoring Wells 1 and 2.
- Monitor Ion Exchange and Redox mechanisms.
- Determine injectate direction and velocity.

CYCLE NO. 2

Injection Volume: 43 million gallons (132 acre-feet)

Bubble Radius: 170 feet

Storage Period: 33 days

- Reconfirm injection hydraulics.
- Monitor well plugging/backflushing rates.
- Monitor Ion Exchange & Redox reaction mechanisms.
- Monitor recovery efficiency.
- Evaluate water quality changes during storage.

CYCLE NO. 3

Injection Volume: 86 million gallons (264 acre-feet)

Bubble Radius: 230 feet

Storage Period: 95 days

- Monitor longer-term well performance trends for injection.
- Monitor injected water quality stability and equalization in the aquifer.
- Monitor THM and HAA degradation.
- Quantify aquifer mixing/dispersion parameters.
- Determine economic factors of pumping, injection, recovery efficiency, backflush percentage.
- Monitor recovered water 'post extraction' for rechlorination and THM/HAA reformation.

CYCLE NO. 4

Injection Volume: 130 million gallons (399 acre-feet)

Bubble Radius: 290 feet

Storage Period: 92 days

- Verify longer term well performance trends for injection.
- Verify injected water quality stability and equalization in the aquifer.
- Verify THM and HAA degradation.
- Verify aquifer mixing/dispersion parameters.
- Verify economic factors of pumping, injection, recovery efficiency, backflush percentage.
- Verify recovered water 'post extraction' for rechlorination and THM/HAA reformation.
- Confirm groundwater quality; confirm return to 'native' background water quality.